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REPORT ON THE THIRD UNITED STATES TRIAL INSPECTION EXERCISE [1]

Introduction

The United States government is continuing to develop inspection procedures which will contribute to monitoring and verification measures for a Chemical Weapons Convention (CWC). In February 1989, United States experts conducted a National Trial Inspection (NTI) at the facility operated by Akzo Chemicals Inc., in Gallipolis Ferry, West Virginia. In March 1990, the United States conducted the second NTI at Alcolac Inc., in Baltimore, Maryland. Both of these exercises tested routine inspection procedures. The NTI which is the subject of this paper, was a challenge inspection conducted in September 1990 at Monsanto Agricultural Company's Luling, Louisiana plant. These trial inspections are viewed as the continuation of the process to develop inspection procedures, not as a test of procedures that are close to final form. The results of the first United States NTI were reported in CD/922, 22 June 1989. Results on the second NTI exercise were reported in CD/CW/WP.301, 27 June 1990.

The purpose of this exercise was to conduct a challenge inspection of industry utilizing a negotiated, managed access approach. It included assessment of production capability, possible presence of CW materials, and host/observer State simulation. Additionally, a variety of detection equipment was utilized and the equipment performance was evaluated.

The scenario for the challenge inspection was based on the allegation that sarin was being produced at the site. The challenge was issued on the entire site, but the glyphosate (phosphorus herbicide) facility was a primary concern. Thus, the inspection focussed on that specific facility, related buildings, waste areas and relevant documents. The inspection was conducted using a negotiated managed access approach providing for a

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[1] Terminology used in this report does not coincide necessarily with that of CD/CW/WP.352. This Trial Inpection, NTI-3, was conducted prior to the complete formulation of our position on challenge inspection. In fact, lessons learned from NTI-3 influenced the development of the U.S. position. In particular, our experience suggested the need for an iterative approach to the determination of a final perimeter.

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gradual, increasingly intrusive inspection taking into account protection of sensitive proprietary information, while seeking increasing access to areas of the site relevant to the alleged violation.

A. GENERAL APPROACH

1. Objectives of the NTI

The main objectives of this challenge inspection were as follows:

- to examine negotiation of a site perimeter and access within the perimeter as a means to investigate the allegations of the challenging State;
- to determine whether Schedule 1 chemicals were produced at this site;
- to determine whether the consumption of a Schedule 3 chemical, phosphorus trichloride, could be verified and the resulting inventory accounted for;
- to determine whether the variety of detection and monitoring equipment brought to the site was effective for achieving the objectives of the challenge inspection;
- to assess effectiveness of on-site monitoring and sampling and off-site analysis in conducting a challenge inspection;
- to evaluate the roles of the host State and observer State and assess the impact on a challenge inspection;
- to determine the workload entailed with securing a site and monitoring the gates and perimeter during an inspection;
- to determine the need for confidential business information in a challenge inspection and the potential for its loss.

2. Provisions in the draft convention under which the NTI took place

The NTI drew on the provisions governing challenge inspections as set forth in the Addendum to Appendix 1, Protocol

on Inspection Procedures, Part I and Part III contained in CD/1033.

3. Type of on-site inspection

The NTI was based on the challenge inspection of an undeclared facility.

4. Advance information

In order to utilize the facilities of Monsanto Agricultural Co., a control group formulated an understanding with Monsanto on "what to expect" and "how to play" the exercise. Because it was a challenge of an undeclared facility, no facility agreement would be available. The inspection team was not provided with any site-specific advance information.

5. Type of facility inspected

The site contained six separate production facilities, all essentially single-purpose chemical units using both batch and continuous processing. Three of the facilities were associated with the production of the herbicide, "Roundup".

6. Type of activity at the site

The inspected site included the following activities:

- production of ammonia;
- production of a phosphorus herbicide utilizing phosphorus trichloride as a raw material;
- production of chlorinated isocyanurates (ACL);
- production of acetaminophen;
- the necessary other activities to support an industrial chemical plant, e.g., control labs, power/utility/operations, fire and safety support, rail yard and receiving/shipping activities and waste disposal operations.

7. Actual activity at the site

All facilities were in operation. However, no access within the acetaminophen facility was allowed. This facility was

owned by a chemical company separate from Monsanto. Access was denied because no permission had been sought from its owners by Monsanto or the US Government.

A distinct feature of this plant and most others in the warm climate of the southern United States was the open construction where no other walls existed. As a result, each of the facilities was observable from its immediate border and the types of equipment being utilized were readily identifiable. This factor greatly facilitated the inspection.

B. DETAILED APPROACH

1. The inspection mandate

The challenge inspection was based on the simulated mandate by the Technical Secretariat to investigate charges made by a State Party under Article IX of the proposed CW Convention that sarin was being or had been produced at this site. Also the mandate was based on the informal understanding between a control group and Monsanto on the extent of the inspection and how Monsanto would "play" the role of the challenged party.

2. Composition of the inspection team

The inspection team was composed of:

- team leader;
- deputy team leader, policy expert;
- two chemical engineers knowledgeable in the production of Schedule 1 chemicals;
- two chemists knowledgeable in sampling and analysis;
- one records specialist;
- four detection specialists knowledgeable in the operation of the variety of air monitoring equipment brought to the site;
- one meteorological and diffusion expert to provide guidance on where to obtain air and soil samples;
- one physical protection/safety specialist;
- one Monsanto chemical engineer to assess the potential loss of confidential business information during the inspection.

The team was complemented by two US Government employees playing the role of the host State representative and the challenging State observer.

In addition, there were two controllers and six observers who witnessed the NTI.

3. Inspection equipment

The following equipment was brought to the site:

- A mobile laboratory that included a power generator, lab hood, refrigerators, a portable PC and printer, and a secure cellular phone with verbal and data transmission capability.

- A cargo-style mini-van to transport inspectors and sampling equipment to the various sampling locations.

- A meteorological station with a 20 foot tower.

- A global positioning sensor (GPS), to assist in finding site locations and to determine the position of all sampling points.

- Sampling equipment such as bottles and jars, scoops, tongs, filter paper, pumps with absorbent tubes, seals, packaging materials, etc.

- Detection and monitoring equipment as follows:

  - chemical agent monitor (CAM)

  - Gas chromatograph analyzer (MINICAM), calibrated for the detection of sarin (GB)

  - Mobile mass spectrometer (MMI), programmed to identify sarin, isopropylamine, p-nitro phenol, and glyphosate intermediate (GI). Since it was known that sarin would not be present, the other chemicals listed (associated with the Monsanto site processes) were used as agent surrogates for the purpose of testing the detection and monitoring equipment.

  - M256 Chemical Agent Detector Kit

  - M272 Chemical Agent Water Testing Kit.

- Industrial hygiene air sampling tubes (Draeger tubes), for the detection of chlorine, phosphorus esters, and ammonia.

4. Activities prior to the arrival of the inspection team on-site

General planning for a challenge inspection was developed by a controller group based on the Addendum to Appendix I, CD/1033. The controller group made several trips to the site and an informal understanding was negotiated with Monsanto on the facility official's role during the challenge inspection. There was no interface between the planning group and the inspection team to provide the inspection team with advance information about the site.

The inspection team was notified several weeks in advance of the name and location of the site to be inspected. At that time, members of the team started to assemble the inspection equipment and supplies. The team was given a general plan for challenge inspection together with process information on the synthesis of chemical warfare agents and a detailed paper on the sarin production process. The team members were assigned to groups and tasks for a challenge inspection team were reviewed. Details on the site and the specific challenge were not discussed.

Six days prior to the inspection, the team was given some background information about the site which was obtained from the open literature. On the evening prior to the start of the inspection, the team met and reviewed the literature, an overhead photo of the site, and an old (1978) site drawing. This procedure of limiting access to site data was adopted to add realism to the inspection. The team members were supposed to be specialists on inspections with little knowledge of the actual site to be inspected.

5. Advanced preparations on-site

No special preparations were made on-site except for alerting the individuals who would serve as escorts during the inspection. The Monsanto plant general superintendent for engineering served as the point of contact and chief facility officer at the site during the inspection. He was assisted by five other Monsanto facility officials during the course of the inspection.

6. Duration of inspection

The inspection lasted three days with 9 hours/day spent at the site.

7. Measures to protect confidential business information (CBI)

Confidentiality was a primary consideration in planning and executing the NTI. Monsanto required all participants in the exercise to sign a security agreement which stipulated that all sensitive information and specialized knowledge acquired with respect to the plant and its processes would be maintained as confidential and protected. It was also agreed to allow a Monsanto chemical engineer from another site to participate as a member of the inspection team. This individual's primary role was to determine the extent to which proprietary information could be obtained using the inspection procedures adopted for this challenge inspection.

8. Opening conference

After the participants were introduced, the inspection team leader stated that the team was prepared to conduct a challenge inspection based on the allegation that sarin was being produced on the site. All participants then signed the security agreement. A facility official provided a safety briefing and indicated the necessary safety equipment and clothing for each activity planned. The plant manager presented an overview, providing historical as well as current information on the operations at the site.

The first activity conducted was to indicate the manner in which the site would be secured. (This is discussed in detail below.) The next activity of the challenge inspection was the perimeter negotiations conducted between the inspection team leader and the host State representative supported by the facility officials. Using an overhead photo and tour of the public boundary of the site, a provisional perimeter was negotiated. This would be the operating perimeter for initial sampling and detection monitoring. A site was also negotiated for locating the meteorological tower which would determine wind parameters and provide the data for further sampling and detection within the perimeter. The provisional perimeter was within the fenced public boundaries of the site but generally far enough away from operating facilities so that details of the operations could not be determined.

The opening conference required about two hours. Other activities were begun concurrently, such as securing the site, unloading the inspection equipment and starting up equipment which required warm-up and calibration.

9. Plant orientation tour

Immediately after the opening conference negotiations, a tour of the provisional perimeter of the facility by part of the inspection team was conducted. The tour provided the basis for sampling at the perimeter and facilitated negotiations for further managed access within the site.

Later, additional negotiations were conducted for further access within the provisional perimeter and also for access within the facilities. Another tour was negotiated which consisted of an escorted drive through the entire site and around each operating facility without exiting the vehicle. On the basis of this tour, the final plan was developed for managed access to the facilities of concern.

10. Securing the site

One of the first items at the opening discussion was to indicate that the site would be secured. Gate inspectors were deployed to ensure all gates were closed. For this challenge inspection, the securing of the site was simulated by first deploying the inspector with an escort to inspect all gates along the boundary fences and selecting one gate to monitor traffic. The sealing of the closed gates was simulated and all traffic was to be directed through the one open gate. Vehicles would be inspected and samples taken to verify contents. No inspection sampling was actually performed, but the gate was manned for various periods to record vehicle traffic. A study was made of the manpower requirements to adequately secure the site and monitor the traffic during a three-day inspection. (Results are reported below.)

11. Inspection of areas and process equipment

The inspection started at the negotiated provisional perimeter. Samples of water, soil and vegetation were obtained based on a general statistical sampling plan based on the down wind direction. Monitoring with air detection equipment was also conducted at the same locations. No information on the operating facilities was immediately obtainable at the provisional perimeter, even with binoculars.

After access within the provisional perimeter was negotiated, the sampling plan was continued up to the exterior of the various manufacturing facilities. Because of the open type construction, provision of access within the site up to the outside of the operating facilities provided considerable information. The site had six separate production areas, three associated with herbicide manufacture. Observation indicated there were no exclusion areas or walled-in

operations with special ventilation. These are considered signatures for hazardous or toxic operations. None of the facilities had high efficiency-type scrubbers or stacks and there appeared to be no distillation columns. All of these types of equipment are considered fundamental requirements for production of sarin, by any of the many routes of synthesis.

Following the negotiated access procedures, the next step was to request access within the facilities. The ammonia facility was not suspect and access was not requested. The chlorinated isocyanurates facility was inspected from the outside and, except for checking some chlorine cylinders, was of no interest. The acetaminophen facility lacked the above specified prerequisite equipment for sarin production and the team accepted denial of access. However, as an alternative, the sampling team took samples around this facility.

The area of primary concern and interest was where the glyphosate intermediate was produced with phosphorus trichloride as a basic raw material. Access was allowed to this facility for observation of the equipment. Air, water, solid and wipe samples on and near this equipment were obtained. This area had reactors and heat exchangers, but lacked the distillation equipment necessary for sarin production. The only closed-in areas were the instrumentation control areas, which contained no process equipment. The phosphorus trichloride lines were traced from the rail car unloading area to the process equipment area to determine whether there was any possible diversion of phosphorus trichloride.

12. Inspection of drawings and operating procedures

Once it had been established that the requisite production equipment was not present to produce sarin or related Schedule 1 materials, the host State representative would not allow access to further information at the site. Access to piping and instrument diagram (PID) drawings, operating procedures, or the chemistry were denied. Denial was based on a need to protect confidential business information. The host State representative pointed out that absence of the requisite equipment and results from the inspection team's sample analysis should satisfy the challenge concerns. This was accepted by the inspection team.

13. Inspection of records

Monsanto provided information on the amounts of phosphorus trichloride received and consumed and amounts of glyphosate intermediate produced. Facility officials showed the inspectors some records to verify the receipt and monthly usage of phosphorus trichloride, but beyond that all other information

was denied. Denial was based on need to protect confidential business information as indicated above.

14. Interview of operating personnel

The inspectors requested an interview with facility operating personnel to establish facts related to the allege production of sarin. Three senior technicians were selected at random by the inspection team and interviewed. They had an average of 14-15 years experience at this plant. They were independently questioned on the use of phosphorus trichloride at the site, protective equipment used and special safety training related to the production of a Schedule 1 lethal chemical. All of the questions were answered consistently to indicate phosphorus trichloride was not used any place else on the site other than the glyphosate facility and no highly toxic or lethal materials were ever produced or handled on the site requiring special training or special protective clothing.

15. Sampling

The following samples were taken by inspection team members:

a. Outer perimeter

- water samples, where available;
- soil samples controls, locations determined by meteorological data;
- soil samples at locations evenly spaced around the perimeter; and
- a small number of vapor samples at locations west and south (downwind) of the chemical process areas were taken with the CAM, MINICAM and MMI.

b. Inner perimeter

- water, soil, and vapor samples at the near exteriors of the four main chemical process facilities (glyphosate intermediate (GI), ammonia, ACL, and acetaminophen). Vapor samples were taken with the CAM, MINICAM, and MMI;
- process input water;

- cooling tower water;

- water from the ACL waste collection pond;

- water from the general wastewater treatment ponds; and

- water from the sump near the acetaminophen facility.

c. GI facility

- wipe samples at a hydrolysis tank;

- wipe samples at a reactor;

- wipe sample at a centrifuge;

- wipe sample at a dryer cyclone; and

- vapor samples taken with the CAM and Draeger tubes at the mechanical agitator bearings of the reactors.

The following samples were taken at the GI facility by Monsanto personnel in the presence of inspectors:

- GI product from a dryer cyclone; and

- liquid (phosphorus-containing waste) from the centrate tank outlet to the well pond.

The following samples were taken by Monsanto personnel at the GI facility prior to the inspection. (These samples were prearranged by the control team, in lieu of interfering with or stopping production.)

- gaskets from reactor vent lines; and

- filter cloth from a centrifuge.

16. Handling of samples

Each sample was given a code number, and the container was labeled and sealed. Sample date (code number, sample type, sampling location) were kept in a log book. The samples were in the possession of the inspectors at all times during the NTI. For overnight storage, the samples were packed in ice and locked in the cargo van used to transport inspectors and sampling equipment to the various sampling locations. The van also served as the workspace for subdividing the soil and liquid samples into four portions, each of which was labeled and sealed. One portion

was for local analysis and one portion of each divided sample was left with Monsanto. The other two portions were packaged, taken to the airport by the inspectors, and shipped by commercial air carrier to a US Army laboratory and a Department of Energy laboratory for dual analysis.

17. Analysis of samples

Samples were analyzed to verify the stated use of the Schedule 3 chemical, phosphorus trichloride (a G agent precursor), and to check for the presence of surrogate chemicals. The samples were also analyzed for the presence of sarin.

Process, water, soil, wipe, and vapor samples were analyzed off-site at US Government laboratories. The following analytical methods were used:

- nuclear magnetic resonance (NMR): to check for the presence of the phosphorus compound structure unique to G agents (process, water, soil, and wipe samples);

- flame photometric gas chromatography (GC): to check for the presence of trace quantities of phosphorus compounds (water samples); and

- gas chromatography - mass spectrometry (GC-MS): to identify chemicals present at trace levels (process, water, soil, wipe, and vapor samples).

18. Closing conference

The closing conference was conducted by the inspection team leader and the host State representative assisted by the facility officials. The team leader reviewed the three days' activities, stating that the inspection team was given adequate opportunity to satisfy the concerns about the facility's alleged production of sarin, with the exception of limited access to the company's records. This prevented the inspectors from achieving one of the objectives of the inspection, namely to verify and account for the disposition of the phosphorous trichloride consumed in the glyphosate process. The host State representative said that access to the records was intrusive and was not needed to prove that sarin was not being produced. The team leader stated that final conclusions on the site's activities would be subject to the results of the off-site analyses.

19. Anomalies, disputes and complications

No anomalies were intentionally introduced, however, one of the instruments produced a response indicating sarin when

sampling near the glyphosate facility. This was not planned and is discussed in the RESULTS section.

Complications were introduced when inspectors found that one of the producing facilities (acetaminophen) was owned by another company and access was denied. This turned out to be of minor consequence because of the type of construction where the process equipment could be viewed from the outer border of the facility. Also as an alternative, samples were taken around the outside of the facility. This could be a major issue in facilities where walls preclude observation from the outside and would have to be dealt with through the negotiating process.

20. Impact of the inspection on facility operations

This inspection had no impact on actual plant operations. However, the time and effort required by the facility officials was substantial. About 35 man days of effort were expended in meetings, preparation and work with the control group and participation in the trial inspection.

21. Inspection team rights

The facility officials required the inspectors to sign a security agreement which addressed the protection of confidential business information obtained during the inspection. This document also contained a paragraph releasing the owners of the facility from any liability due to loss or expense of claims from physical injury (including death) or property damage arising out of the visit to the plant. The issues of inspectors' rights and physical protection, protection of CBI, and liability must be provided for in the convention and possibly in State Party implementing legislation.

C. RESULTS

1. Inspection planning

A conclusion of each NTI conducted by the United States has been the need for good planning. This was demonstrated again during this exercise. However, there is an inherent difficulty in planning a challenge inspection and providing realism. Because there is no facility agreement, the detailed data available and that provided to the inspectors may vary considerably from facility to facility. The specificity and timeliness of providing data also have an effect on the inspection plan, particularly in the initial phases of a challenge inspection when the plan is being developed and it is desirable to move quickly.

This inspection demonstrated that good planning will provide for efficient division of labor, allowing the inspection

team to conduct concurrently gate monitoring, sampling, detection and monitoring and analysis. Some of these tasks should be initiated while negotiations on access are ongoing. The inspection also demonstrated the need for each inspector and inspector assistant to have a standardized check list of procedures. Many of these functions should be started immediately after the facility officials have provided the site indoctrination.

2. Challenge inspection approach

The approach taken in this exercise was based on the mandate of Article IX and Appendix 1, Addendum (CD/1033). A provisional perimeter and a perimeter sampling plan were negotiated in two steps: before and after a tour of the perimeter. The tour identified points, such as geographical constraints and sensitive areas, and allowed negotiating closer access to parts of the site under concern.

This inspection demonstrated that before developing and negotiating the final inspection plan for access within the provisional perimeter, a tour of the provisional perimeter and tour through the site greatly facilitated the negotiating process and effectiveness of the actual facility inspection. The subsequent negotiations led to a plan which addressed the proprietary and national security concerns of the challenged State and minimized unreasonable intrusiveness.

3. Production equipment inspection

As reported above, the nature of the building construction at this site allowed visual inspection from the exterior of each facility. This gave inspectors sufficient chance to look for the required equipment to produce a Schedule 1 chemical such as sarin. If they did not have this opportunity, they would have had to negotiate access inside or rely entirely on the results of sample analysis from the outer border of the facilities.

Access was permitted to the glyphosate intermediate facility which was of primary concern. Here too, key process equipment to produce sarin was missing and there was no indication of the production of a highly lethal/toxic chemical. Information was not provided on the chemistry involved, other than the starting raw material, phosphorus trichloride, and the final product. Also, no piping and instrumentation drawings were provided. The inspectors were allowed to take solid, air, water and wipe samples within this one facility to confirm the absence of sarin and its hydrolysis products. By tracing the pipe lines they also confirmed that phosphorus trichloride was not diverted from the rail car unloading position and was only piped to the process reactors in the glyphosate facility.

4. Records audit

The inspection team's request for records to determine a material balance for phosphorous trichloride, chlorine, fluorine and isopropyl alcohol was turned down. The facility official's response was that they would provide enough other information to show where the phosphorus trichloride was going; that it was used to produce glyphosate intermediate and Roundup as they claimed; that chlorine was not used in the glyphosate facility; that fluorine was not used at the plant and that isopropyl alcohol was not used in the glyphosate facility. They did provide data to confirm their phosphorus trichloride receipt and allowed review of consumption data for several randomly selected months. From this data, the inspector could confirm that their original declaration for phosphorus trichloride was consistent with the records. Beyond this, no information was provided because it was considered confidential business information which would reveal conversion efficiencies and production rates.

5. Detection and monitoring equipment

The detection and monitoring equipment provided real time or nearly immediate on-site analysis of air samples. The instruments used vary in size, weight, sensitivity, and specificity. The mass spectrometer detected and identified the surrogate, isopropylamine, at several locations on the negotiated outer perimeter.

The most sensitive instrument used, the MINICAM, is essentially a gas chromatograph which is non-specific. Some of the air samples taken near the glyphosate intermediate (GI) facility produced responses in the MINICAM's sarin "window" of detection (the MINICAM was upwind from the GI facility). When this occurred, other instruments and sampling devices were brought to the spot. The more selective but less sensitive mass spectrometer could not detect the smaller concentrations picked up by the MINICAM. Other air samples taken at the same location and analyzed later (off-site) contained only isopropylamine, a compound thought to be too volatile to have caused the MINICAM response. A compound that likely caused the response was believed to be phospholane which was detected off-site using sensitive gas-chromatograph/mass spectrometry equipment. The source of the phospholane was not known.

The CAM, agent detector kits, and Draeger tubes produced no responses for sarin or agent surrogates wherever used during the inspection.

Further work is needed concerning the types and portability of equipment to be used at an inspection site, and on

procedures for standardization and calibration of such equipment. Current transportation regulations governing shipment of hazardous chemicals pose limitations on the transport of toxic/control samples (for calibration of instruments) to the inspection site and work is necessary to resolve this problem.

6. Sample analysis

No portable equipment for on-site analysis of liquid and solid samples was available. The Monsanto laboratories were fully occupied and were not available for NTI use. Because of these resource limitations, samples were analyzed off-site at US Government laboratories.

Sampling was divided into three areas with respect to geographical distance from the production facilities, based upon a generic sampling plan and negotiated perimeters. Outer perimeters were defined. Inner perimeters closer to the plants were defined. At the inner perimeters, samples were collected to within 50-100 feet of production facilities. Additionally, samples were collected within the glyphosate intermediate (GI) production facility. Thus, the data base generated during this NTI consisted of air samples and environmental samples (soil, water) from inner and outer perimeters, and wipe samples and process samples from the GI facility.

For the purpose of this exercise, three chemicals were designated as surrogate compounds. They were isopropylamine (a compound used in the herbicide manufacturing process which has a volatility comparable to sarin), para-nitrophenol (a precursor to the manufacture of acetaminophen, a process that is conducted in one facility at the NTI site), and GI (used to produce the glyphosate herbicide).

At the outer (provisional) perimeter there was no evidence of two of the surrogates (para-nitrophenol and GI) in the water, soil, and vapor samples. The other surrogate, isopropylamine, was detected in water samples and detected at trace levels in a few soil samples. However, isopropylamine could be in the water and soil as a degradation product of the herbicide "Round-up" used for vegetation control at the site, and not as a production facility effluent.

At the outer perimeter, four vapor samples from three locations tested positive for the presence of isopropylamine. There was one occurrence of a real-time detection of isopropylamine by the mobile mass spectrometer (MMI) at an outer perimeter location. From these results, it might be reasonably concluded that if vapor samples were taken at a plant that was producing sarin, and this plant was not employing environmental controls for the emission of sarin, and an air sample was taken downwind of a plume from the process, there would be no

difficulty in detecting the presence of sarin. However, it is also realistic to assume that in the presence of inspectors, any clandestine operating involving sarin would not be occurring. Thus, air sampling at the outer perimeter would be expected to yield negative results during an actual inspection.

At the inner perimeters, there was no evidence of two of the surrogates (para-nitrophenol and GI) in the water, soil, and vapor samples. Isopropylamine was detected in water samples at much higher levels than at the outer perimeter, and detected isopropylamine could be present in water and soil as a degradation product of herbicide used for vegetation control, and not as a production facility effluent.

Two (one water and one soil) of the five environmental samples collected at inner locations close to the acetaminophen production plant tested positive for para-aminophenol (PAP), a compound likely to be generated by the degradation of acetaminophen. This compound would not be expected to be found in normal environmental samples, and can be linked to the presence of acetaminophen or its production.

Ten vapor samples were taken at various inner perimeter locations. All tested positive for the presence of isopropylamine.

One of the wipe samples taken at a reactor within the GI plant tested positive for GI.

While it is based upon this limited data base, it can be stated that environmental samples (solid and water) collected close to the site of operations are valuable, and increase the probability of detection of compounds of interest.

It is important that a continuous chain of custody be maintained once samples are obtained. Sample containers must be properly labeled and sealed with tamper-proof seals. A log and a coded numbering system should be used to protect the identity of the facility when the samples have left the site. Access to samples or any information about the inspected site should be limited to those persons with a "need-to-know."

Although not a problem for NTI-3, the stability of samples is another concern. Samples must be handled and stored in a manner such that their integrity is maintained. This, plus the possible limitations on the transport of hazardous chemicals because of government regulations, requires that the packaging and shipping of samples be well thought out and standardized to avoid problems.

7. Security the site

The purpose of securing the site is to ensure that no prohibited chemical is removed during the inspection. This site size of over 1500 acres presented a difficult problem to secure. The inspection team did not include sufficient manpower, but it was decided to simulate the activity and gather enough information to determine what resources would actually have been required. This site had approximately 8 miles of outer fence line and 26 gates, 10 of which had external access for truck or rail traffic.

Inspection showed that all but one gate could be sealed without adversely affecting plant operations and that gate was monitored. There were three railroad gates, two of which were used once per day and the third about once per month. The plant also had three loading points for river transportation. One barge dock was for receiving fuel oil. Two other docks were for bulk loading of ammonia and a chlorinated product. None of the three were located such that containerized chemicals could be loaded without passing through one of the perimeter gates. All gates except the one traffic gate were assumed to be secured with tamper-proof seals.

The main traffic gate was assumed to be manned with one inspector and one assistant per shift to monitor existing traffic around the clock. The team would be required to inspect each vehicle, examine its contents, test (perhaps with a CAM) for prohibited material and sample randomly to verify the contents of drums or tank trucks. This is a labor intensive activity and will create some delays at the gate. It would also require protective clothing and decontamination capability, if toxics were detected.

During a two-hour monitoring session at the main gate, 65 trucks entered and exited. Among these were light pickups, trash trucks, parcel delivery trucks and 18-wheel semi-trailer trucks. One of the semi-trailer vans was sealed at its loading point in the plant and would have presented a problem. It was filled with pelletized drums of "Roundup". Had the inspection team attempted to inspect or sample this truck or other vehicles, considerable labor would have been involved.

The manpower estimate to secure this site is eight inspectors or assistants. This is based on two shifts operating around the clock, twelve hours on and twelve hours off. The shift would include two inspectors at the gate at all times and two roving people to monitor the fence and assist at the main gate during heavy work load periods.

Another issue which was not adequately investigated and was related to removal of prohibited materials from the site was monitoring the waste flows leaving the site. Waste streams were sampled and there was considerable hold-up in the waste system which should capture any chemicals should washing of the system have been attempted. However, there was an effluent line leaving the site to the river which was not monitored but should have been assessed. Such a system could possibly be utilized to remove surreptitiously evidence of prohibited activities and should be carefully inspected.

8. The inspection team

The exercise demonstrated the need for extensive expertise in chemical engineering, chemical production, and analytical chemistry. There was a need for meteorological assistance to determine where best to obtain samples of both the air and the soil. There also was a need for inspector assistants to monitor gates and fences, to unload equipment, to pack samples, and provide on-site support. The variety of detection and monitoring equipment also required expertise in operation and maintenance. The team also included a policy expert who provided assistance to the team leader during the negotiations sessions. This team of thirteen did not include interpreters and a full component for securing and monitoring the fence and gates. The team size was based on conducting the inspection in about three days (functioning 9 hours per day).

9. Confidentiality

Protection of confidential business information must be taken into consideration in a challenge inspection to the maximum degree possible consistent with verification requirements. As soon as it was established that the facility lacked distillation/fractionation columns and basic safety equipment for the production of sarin, the host State representative and facility officials denied the inspection team access to further detailed information. The facility officials stated they would not provide records to establish a material balance because this would allow the inspection team to calculate conversion efficiencies and production rates which they considered CBI. They would not provide the details of the chemistry taking place in the glyphosate facility because it was CBI. However, they agreed to allow the team to trace the phosphorus trichloride feed lines from the receiving point to the reactors to assure the inspectors that there was no diversion to other facilities. The inspection team accepted the consistent effort to allow the team access to information (including sample-taking) to verify sarin was not being produced, but no further access to proprietary information.

The Monsanto representative who was on the inspection team to determine the extent of CBI he could obtain, determined there would be a loss of such information. He stated he was able to obtain enough information about the glyphosate intermediate process merely by equipment inspection to save a potential competitor considerable process development, time and dollars. He said a knowledgeable inspector could compromise Monsanto's proprietary business interests with no access to their records beyond the quantity of phosphorus trichloride consumed. It must be noted, however, that he concentrated solely on this task for 2 1/2 days. He did not perform as an inspector and he was not watched as closely by the escorts as the other team members were.

This points out the need for inspection procedures to minimize loss of such information, for example, through limiting time at locations and to insure access only to that information and areas needed to answer the challenge objective.

10. Areas requiring further work

This inspection has continued to make clear the need to conduct additional trial inspections to test each regime and monitoring aspect of the planned convention. Trial inspections at government installations as well as in the chemical industry must be conducted to determine how best to conduct an inspection and how best to protect both national security and proprietary information.

A need exists for the development of sensitive, portable analytical equipment which can be brought with the inspection team and operated on-site during an inspection.

A challenge inspection will require access to and use of some confidential business information. It is necessary to develop reliable procedures to protect CBI as much as possible and ensure that it is only used within the Technical Secretariat on a need-to-know basis.

While procedures need to be flexible to allow for negotiations and individual site circumstances, provisions for challenge inspections need to be contained in the inspection protocol to establish basic rights and responsibilities to minimize the amount of negotiation at the beginning of each inspection.

Responsibilities and obligations of the host State and inspectors should be provided with respect to rights concerning activities such as photography, sampling, interviews, access to documents, etc. Negotiations at the site would then focus on site specific aspects, such as "where" to sample or "what" to photograph.

D. CONCLUSIONS

With respect to the challenge, no capability to produce sarin or confirmation of the presence of sarin on-site were found.

Access to the provisional perimeter facilitated negotiating minimum distances from facilities of concern for further sampling locations. Negotiations on access within the provisional perimeter similarly are best conducted after a tour of the site has been provided by the facility officials.

At this facility, no meaningful conclusions either supporting or refuting the challenge (production of sarin), could have been made if the challenge inspection had been restricted to the provisional perimeter. Access to site locations in close proximity to or within key process areas permitted the gathering of the information needed for reaching the conclusion that no sarin and no capability to produce sarin existed at this facility.

Inspection of the chemical production equipment is the most important aspect of determining the presence or absence of capability to produce Schedule 1 chemicals at a site. If the necessary process equipment and safety equipment are not present, production of prohibited materials is unlikely.

Material balances cannot independently provide confirmation of a chemical facility's activities, but can provide relevant supporting information in a challenge inspection. However, without clear guidelines in the CW convention, access to this information could be resisted and meager, if provided.

If on-site analysis gives an indication of illicit materials, such information should be useful in negotiating additional access. There should be some redundancy in the analytical equipment to deal with false positive and false negatives in the analyses.

Each inspector requires a check list of duties and responsibilities to assist his operations, particularly in a challenge inspection where there is no facility agreement and the site is unknown to the inspection team.

The role of the challenging State observer(s) and his prerogatives for requesting inspectors to undertake activities during a challenge inspection should be further defined in the proposed CW convention.

The workload entailed with securing a site and monitoring gates and fences is formidable and must be provided for.

The potential for loss of CBI during challenge inspection is likely. A challenge inspection must be intrusive enough for clarification of concerns, however, procedures for access must allow for measures to protect against loss of irrelevant CBI as well as to protect relevant CBI. Further work is necessary, for example, to deal with inspection team access, time at specific locations, and revealing size or specifications for equipment and process flow rates.